Amendments to the Drawings:

Please replace sheets 1-7 of the drawings with the attached replacement sheets 1-7. The replacement sheets incorporate the desired changes in the drawings, and each sheet includes all of the figures that appeared on the immediately prior version of that sheet.

Attachment: Replacement Sheets 1-7.

Remarks:

These remarks are responsive to the Office action dated August 9, 2007. Prior to entry of this response, claims 1-15 were pending in the application. By way of this response, claims 1, 2, and 8 are amended and claims 15 and 16 are cancelled. Applicants respectfully request reconsideration of the application and allowance of the pending claims.

Examiner Interview

Applicants thank the Examiner for the courtesy extended during the August 16, 2007, interview. In the interview the missing drawing was discussed. The Office action states page 7 of the formal drawings is missing, however, after downloading all documents that were submitted on May 7, 2007, page 7 was found to be scanned in with an affidivit rather than with the drawings. The Examiner acknowledged that mistakes are often made in scanning documents and requested all drawings be resubmitted in order to have the drawings all together.

Formal Matters

The drawings are objected to as page 7 is missing. Applicants have resubmitted the drawings with this response to the Office action.

Applicants have also corrected an antecedent basis error associated with claim 1, which as currently amended recites in part: "said rich exhaust gas mixture having a rich air-fuel ratio, wherein the rich air-fuel ratio is selected as a function of at least the oxygen storage capacity of the device.". The amendment to claim 1 is fully supported by the specification as originally filed by Applicants, and was not made in response to any prior art presented during examination.

Rejections under 35 U.S.C. § 102

Before addressing the various rejections presented by the Office action, Applicants believe it may be beneficial to first review some background information.

As described by Applicants' specification (e.g. see background and summary), oxygen storage capacity (OSC) can affect operation of an emission control device in addition to NOx storage capacity. For example, as described at page 2, line 4 of the specification:

> *In addition to storing NOX during lean/rich cycling, the NOX traps may also provide HC, CO, and NOx conversion when the A/F ratio is controlled about stoichiometry. This is beneficial, for example, during high load operation. If NOX traps contain low amounts of oxygen storage capacity (OSC), the ability of these catalysts to convert CO and NOX under the oscillatory A/F conditions characteristic of closed-loop control systems can be limited. To provide three-way conversion in this oscillatory environment, NOX traps often contain oxides of cerium or mixed oxides of cerium and zirconium. In addition, the cerium may provide OSC during lean operating conditions and release oxygen during the rich operation to providing oxidants for converting the HC and CO.*

Thus, Applicants have not only recognized the issue of NOx storage, but are also addressing the various issues associated with the oxygen storage capacity, namely the ability of the catalyst to provide HC, CO, and NOx conversion in light of a reduced oxygen storage capacity.

In contrast, for example, Yonekura et al. describes degradation of a NOx absorber catalyst in terms of the maximum amount of NOx able to be absorbed. For example, at column 8, line 61 Yonkeura et al. essentially defines the deterioration degree of the NOx absorber catalyst as:

> To this end, it is necessary to detect the maximum amount of NOx able to be absorbed by the NOx absorber catalyst **18**, that is, the deterioration degree of the NOx absorber catalyst **18** with accuracy.

Turning now to the rejections, claims 1 and 3-6 have been rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent Number 6,345,498 (Yonekura et al.). Applicants respectfully traverse these rejections.

Claim 1 recites in part: "said rich exhaust gas mixture having a rich air-fuel ratio, wherein the rich air-fuel ratio is selected as a function of at least the oxygen storage capacity of the device.". In rejecting claim 1, the Office action indicated that:

> - after the lean operation, operating (step 115 with Yes answer, step 116, and Figure 15) the engine to produce a rich exhaust gas mixture fed to the emission control device, the rich air-fuel ratio determined as a function of at least the oxygen storage capacity of the device (when a storage capacity of NOx or oxygen is lowered due to deterioration of the device, an air-fuel ratio is made less rich during a rich operation (see at least the Abstract and lines 13-22 of column 3)).

Applicants have examined Yonekura et al., particularly the citations offered by the Examiner, and have not been able to find any mention, either expressly or inherently, of a rich air-fuel ratio selected as a function of oxygen storage capacity of the emission control device. Furthermore, as previously described, Yonekura et al. appears to equate the degradation of the NOx absorber catalyst with the amount of NOx able to be absorbed by the catalyst, not the oxygen storage capacity of the device.

Since Yonekura et al. does not disclose each and every limitation of claim 1, Applicants respectfully request that the rejection of claim 1 under 35 U.S.C. 102(b) and all claims depending from claim 1 be withdrawn for at least this reason.

Rejections under 35 U.S.C. § 103

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yonekura in view of U.S. Patent Number 6,226,982 (Poggio et al.). Applicants respectfully traverse this rejection.

The Office action indicates with regards to Yonekura et al.:

In the method of Yonekura et al., a NOx or oxygen storage capacity of the device (18) is based on measured transition time from rich to lean (see Figure 16(A)).

Applicants respectfully disagree with this assertion. Applicants have examined Figure 16(A) of Yonekura et al. and have noted that Figure 16(A) instead describes a deterioration degree of a NOx occluding catalyst, and does not mention the oxygen storage capacity. As previously described with regards to the rejection of claim 1, Yonekura et al. does not disclose, either expressly or inherently, the approach of operating an engine to produce a lean exhaust gas mixture fed to the emission control device and after the lean operation, operating the engine to produce a rich exhaust gas mixture fed to the emission control device, where the rich air-fuel ratio exhaust gas mixture having a rich air-fuel ratio is selected as a function of at least the oxygen storage capacity of the device.

Poggio et al. does not appear to cure this deficiency in Yonekura et al. Applicants respectfully submit that Poggio et al. still does not teach selecting the rich air-fuel ratio as a function of oxygen storage capacity. Nonetheless, Applicants have amended claim 2 to include an additional limitation that is not found in any of the cited references. Claim 2 as currently amended recites: "estimating the oxygen storage capacity of the emission control device based on an average of several rich to lean transition times". Applicants have examined the various references of record and have been unable to find any mention of estimating oxygen storage capacity of the emission control device based on an average of several rich to lean transition times. As such, Applicants respectfully request that the rejection of claim 2 be withdrawn.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yonekura in view of U.S. Patent Number 5,970,707 (Sawada). Applicants respectfully traverse this rejection.

The Office action admits that:

Yonekura et al. fail to disclose that the

oxygen storage capacity of the device is determined from rich to lean transition time.

The Office action further asserts that:

As shown in Figure 1, Sawada et al. disclose an engine air-fuel ratio control based on an amount of oxygen stored in a NOx trap (7).

Applicants respectfully disagree with this assertion. In contrast, Sawada et al. discloses a method to evaluate the NOx absorbing capability of the NORC 7, not the oxygen storage capacity. For example, at column 9, line 41, Sawada et al. recites:

> (2) The NORC (the NO_X occluding and reducing catalyst) In this embodiment, the NO_X absorbing capacity of the NORC 7 is evaluated by the following two methods (2A-1) and (2-A-2).

While Sawada et al. does discuss oxygen storage capacity, it is instead with regards to the evaluation of the three-way catalysts 5a and 5b, not the NORC 7.

Applicants further submit that these approaches, as taught by Sawada et al., are separate and distinct. For example, the approach for evaluating the three-way catalyst is presented in section (1) of the specification, while the approach for evaluating the NORC is presented in a separate and distinct section (2) of the specification. Furthermore, Sawada et al. does not provide any teaching, suggestion, or motivation that the approaches of section (1) can be similarly applied to the different hardware (e.g. the NORC 7) associated with section (2). Therefore, Applicants submit that a person having ordinary skill in the art would not be lead to combine the approach of section (1), which was to be applied to a three-way catalyst, with the NORC of section (2) without the benefit of hindsight reasoning.

Thus, not only does Yonekura et al. fail to disclose each and every limitation of claim 7, but Sawada et al. also fails to provide any teaching of how oxygen storage capacity may be considered with regards to an emission control device that is capable of storing NOx. As such, Applicants request that the rejection of claim 7 be withdrawn for at least this additional reason.

Claims 8 and 10-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yonekura et al. in view of Sawada et al. Applicants respectfully traverse these rejections.

With regards to claim 8, the Office action asserts that:

> Yonekura et al., however, fail to disclose that instead of engine operating conditions, the amount of NOx released from the device is estimated based on an oxygen storage capacity of the device.

In characterizing Sawada et al., the Office action indicates that:

> As shown in Figure 1, Sawada et al. disclose an engine air-fuel ratio control based on an amount of oxygen stored in a NOx trap device (7). As indicated on lines 6-21 of column 11, Sawada et al. teach that for every mole of NOx stored or released in the device, the device also stores or releases 0.75 mole of oxygen.

Applicants have reviewed the specific portion of the text cited by the Examiner and respectfully submit that it is unclear whether Sawada et al. teaches an engine air-fuel ratio control based on an amount of oxygen stored in a NOx trap device based merely on the recognition of a chemical ratio of NOx and oxygen. However, even assuming that Sawada et al. teaches what is alleged by Office action, Sawada et al. still does not disclose a rich air-fuel ratio that is selected as a function of at least the oxygen storage capacity of the device. Applicants respectfully submit that an amount of oxygen stored at any particular instance is still not necessarily the same as the oxygen storage capacity of the

device as taught by Applicants. Thus, the mere recognition of a chemical ratio of NOx and oxygen does not imply that the oxygen storage capacity is being considered for the air-fuel ratio control. As such, Applicants respectfully request that the rejection of claim 8 and all dependent claims be withdrawn for at least this reason.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yonekura et al. in view of Sawada et al. and Poggio et al. Applicants respectfully traverse this rejection. As previously described with reference to claim 8, even the combination of Yonekura et al. and Sawada et al. do not disclose each and every limitation of claim 8.

The additional reference of Poggio et al. does not cure this deficiency, since Poggio et al. does not disclose an emission control device capable of storing NOx during lean operating conditions and converting at least a portion of NOx during stoichiometric or rich operating conditions. Thus, this additional reference would again require a person of average skill in the art to combine these various references without any teaching, suggestion, or motivation for their combination. Nonetheless, Applicants have amended claim 8 to include an additional limitation not found in any of these references.

Claim 8 as currently amended recites in part: "estimating an oxygen storage capacity of the emission control device based on an average of several rich to lean transition times". Support for this amendment can be found at page 9, line 2 of the specification as originally filed. As such, Applicants request that the rejection of claim 9 be withdrawn for at least this additional reason.

Claim 15 is cancelled without prejudice, thus rendering moot the rejection of that claim.

Conclusion

Applicants believe that this application is now in condition for allowance, in view of the above amendments and remarks. Accordingly, Applicants respectfully request that the Examiner issue a Notice of Allowability covering the pending claims. If the Examiner has any questions, or if a telephone interview would in any way advance prosecution of the application, please contact the undersigned attorney of record.

Please charge any cost incurred in the filing of this Response, along with any other costs, to Deposit Account No. 06-1510.

Respectfully submitted,

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